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Chapter 12

THE ART OF THRIVING WITH UNCERTAINTY AND ACTING WITHOUT CERTAINTY

One of the amazing elements of the fall of the Berlin Wall was that it took even the most powerful in Germany completely by surprise. The Chancellor of West Germany, Helmut Kohl, was certainly not prepared. He was on a state visit to Washington and had to follow events on television, before he rushed home.

If there is one thing that you learn from working in future studies, it is that the future is hard to predict. Actually, any futurist worth his salt will typically open presentations with a disclaimer, in which he specifies that the purpose of future studies and creating specifically is not to predict, but rather to prepare yourself for the many surprising ways that developments can lead. That's why you typically construct three or four widely different scenarios that can indicate the range of possible developments.

Among futurists the energy behemoth Shell's Scenario Planning Division is considered one of the leaders. There are generous budgets, they have the leading experts and the company has worked with scenarios for decades. Periodically Shell publishes their scenarios for the coming ten years, and in 2001 the futurists indulged in a prediction, stated with a great deal of confidence. They predicted that technology would advance so quickly that they it would overcome the increasing difficulty in obtaining new resources. Therefore oil prices would stay below $ 20 per barrel for at least a decade ahead.
Now, ten years later, we can conclude that even the leading experts can be utterly wrong in their assessment of the future, even in the specific area, that they should be the best qualified to evaluate. The price of oil has been above $20 pretty much ever since the report was published. In 2008 it reached $147 per. barrel.
Hopefully, the failed prediction has led to some reflections among Shell's analysts. It should serve as a reminder that this is how the future is: It is impossible to know what will happen.
And that's the point of this chapter.

From certainty to probability

When dealing with complex dynamic systems, you need to start from the basic premise that it’s impossible to know for certain how the system will evolve. You have to make do with a certain probability.
This is a very different approach from the Newtonian physics, we learned in school. The traditional scientific method divides a problem into small parts and studies them one at a time. To discover the laws of nature scientist had to set up experiments that, as clearly as possible, examined one parameter at a time. The laws described physical events as if they were taking place in some idealized vacuum where billiard balls can crash into each other and transfer their energy perfectly - just like the formulas predict.
But reality does not take place in a vacuum. In reality there are inevitably all sorts of external factors and processes that come into play and make things more complex and messy than a simple formula can describe. The more elements and sub-processes are

in play, the harder it becomes to predict what the processes can lead to,

We must learn to act on probabilities rather than certainties. The more interconnected the world gets, the more often we get into situations in which we can't expect to know with certainty what the outcome of our actions will be.

This might sound slightly unsettling, but in a philosophical perspective, it is precisely this uncertainty that gives humans our freedom and autonomous nature. If everything could be predicted, the world would be predetermined. But the unpredictability means that we are able to influence and change the development. In this sense, uncertainty and unpredictability equals opportunities.

The normal is unusual

When we make plans for our lives or when we think about politics or finances, we typically do so from an assumption that stability and regularity are the norm. We tend to think that it is the long regular stretches that shape the world. In reality the world is complex and it often develops in non-linear, sudden jerks. Everyday life may seem predictable and relatively un-eventful, but more often than not we're actually in a phase of adaptation to the latest big change. The normal is unusual.

In his book *The Black Swan*, US-Lebanese economist Nassim Nicholas Taleb warns of the dangers of believing that the world is characterized by predictability and moderate fluctuations. According to Taleb the consequence of that kind of thinking is that we are poorly prepared for the surprises that *actually* set the agenda - events like 9 / 11, natural disasters and other sudden large conflicts, that take turns capturing the worlds attention and rescue efforts. Or events like the financial meltdown in 2008 that almost caused an entire country - Iceland – to go bankrupt from one day to the next.

Some circumstances are stable and only change slowly. The housing stock in mature Western cities gets replaced at a rate of about one percent annually. Heavy infrastructure takes years to build.

Similarly, some types of fluctuations move within a relatively narrow range. When we look at people's weight or how fast we can run 100 meters, the most extreme occurrence is not far from the average value. If one calculates the average of 10,000 people's height, the number would not be radically affected if the highest person in the world were part of the group or not.

But there are other realms, in which change can happen very quickly, or in which fluctuations can be much more extreme. Our income, the sales of books, movies or music, fluctuations in stock markets or the extent of natural disasters are examples. If you want to calculate the average income of 10,000 people, it would completely change the result if Bill Gates were part of the sample.

When we evaluate a situation, we tend to believe that it is of the first, moderate type, but actually the factors we are trying to assess, are often of the other, extreme type. And therefore we typically focus on the average and the many small and normal events without taking into account that it is a crucial part of the game that sometimes extreme factors can appear that completely change the situation.

As Nassim Taleb concludes: "Although unpredictable large deviations are rare, they cannot be dismissed as outliers because, cumulatively, their impact is so dramatic."

As the systems we act in relation to become more complex, we must prepare

ourselves for another way of assessing what is possible. We are becoming very tightly coupled and we are integrating lots of new elements and players into our systems. The larger and more comprehensive the systems become, the more extreme fluctuations in them can be.

Weightless systems can oscillate without restriction

Large systems can create large fluctuations. Companies can grow larger in a globalized world - just like the sales of a book like Harry Potter or the number of people affected by a virus can reach new proportions.

The biggest and fastest variations are found in systems that are not bound by physical limitations. Apple Computers App-store, which sells applications for iPhones and iPads, reached the first billion downloads in nine months, and passed the ten billion mark after two and a half year. By comparison, it took McDonald's nine years, from 1955 to 1963, to sell the first billion hamburgers.

Skype grew from nothing to being the world's largest provider of international telephony in just five years. One month after the software was released, Skype had a million users, reaching 300 million in five years. In 2009, Skype handled eight percent of all international calls. Such rapid growth would be impossible to implement if Skype should have established a traditional physical infrastructure of cables, switches, satellites, equipment, shops, etc.

The global financial sector has also escaped much of it ties to real, physical values. Securities, derivatives and a wealth of complex financial instruments have made it possible to create huge fortunes extremely quickly by juggling astronomical amounts of almost abstract, money - but as we saw in 2008, the volatility can move just as fast in the opposite direction.

In the documentary movie *Inside Job* the investor George Soros uses the metaphor of an oil tanker to describe how relaxing regulations have made the interdependencies global financial players so strong, that their collective movements can bring the entire system down.

Oil tanker ships are normally divided in to a number of separate vessels, to limit how much the cargo can slush around. If all the oil was in one big tank, its movements could capsize the ship. But in recent years the separations have been removed, so it’s all one big system.

Sometimes, wild swings are simply caused by computers on the stock market firing each other up. On 7 May 2010 the U.S. Dow Jones index suddenly slipped into a self-reinforcing downward spin possibly triggered by a trader who mistakenly placed an order of $ 16 billion of securities instead of 16 million. In just seven minutes, the overall value of the shares of Dow Jones dropped nine percent. This corresponds to a loss of over a trillion dollars - three and a half times the annual Danish gross domestic product. The shares regained two-thirds of their value within a few hours, but the episode shows how quickly the system can get out of control when all the elements it are extremely closely linked.

Wildcards

We face a dilemma. If we try to understand the future in order to prepare ourselves for change, we need to take into account that it will be marked by events that do not follow the general trends. Futurists often try to challenge the established expectations of the future by introducing so-called *wild cards* in their scenarios. Wild cards are

events, which are very unlikely, but which have major consequences, should they occur. For instance, a company could consider what would happen if the CEO died? Or what if a major component in the production was made illegal or was no longer available? How would you cope if there were civil war, if a global epidemic broke out, or there were a significant technological breakthrough that completely changed the industry within a few years? These things do happen.

Wild cards are hard to take into the assessment because they fall entirely outside the usual logic and scale. A company cannot address every conceivable but unlikely situation.
What typically happens in scenario sessions is that the participants end up skipping the wildcards - it is just too much hassle, and it is hard enough already to find enough the time for a discussion of the ”regular” future.
But, as Nassim Taleb points out, the problem is that it is precisely the events that fall completely outside the normal scale, which increasingly determine the development. Who would have thought that the use of Freon in refrigerators and aerosol cans would create a hole in the ozone layer? Or that the use of fossil fuels would lead to the greenhouse effect? It may be a small, overlooked factor that pulls the rug from under us. Or suddenly gives us new opportunities. In 1910,
Plastic was unknown, but half a century later it was everywhere - a fundamental material in all the objects that surround us.

Problems with no simple answer

A simple world has simple answers. In a complex world, answers are less clear. We are accustomed to thinking in either-or, clear-cut answers and absolute truths, but for many of the issues we face today, we must realize that this is not only imprecise, it is often completely misleading.

One of the complex issues that we will be dealing with in the coming years is the interpretation of genetic tests. The vast majority of diseases and weaknesses are not linked to a single gene, rather they are determined by a combination of several genes. Furthermore, genes are not alone in determining our health. Much depends on other factors, such as the environment and our lifestyle.
In the case of a few diseases, like Huntington's chorea or cystic fibrosis, there is a clear link between one particular version of a gene and the disease. But for the most widespread diseases, cancer, cardiovascular disease, asthma, diabetes and depression there isn’t the same clear correlation between the disease and the occurrence of a particular gene.
In a matter of a few years it’s very likely that personal DNA tests will become a normal tool in medical diagnostics - alongside X-rays and blood tests. But DNA tests typically do not give definitive and clear answers. In most cases, a genetic test will just indicate that a person has an elevated or reduced risk of particular diseases.

Genetic tests are an illustration of a general ground rule for the future: That we must learn to act and deal with *probabilities* – because, in ever more cases, we cannot expect to know the outcome with certainty. One cannot know whether cooperation is likely to be beneficial. One cannot know whether a law will have the desired effect. One cannot know whether an investment will be worthwhile.
And yet we must act. We would be paralyzed if we insisted on certainty.

Trust Uncertainty

Psychology shows that people are unhappy with uncertainty. We do not like it if we don't know what will happen or if we are forced into change, we cannot quite grasp. We become uncomfortable, stressed, less happy.

But uncertainty is a basic living condition in a world that is becoming increasingly complex. We must learn to thrive with it. We must learn to embrace uncertainty, understanding that it is in uncertainty that opportunities lie. One has to engage in certain amount of risk, because otherwise you will never get very far.

Certainty comes at a price. You could wear belt and suspenders, carry a helmet and a life jacket at all times, but if you to need to move forward in a hurry, your safety gear becomes a liability.

Creating something new necessarily implies a risk. But - and this is very important - there is also a risk associated with NOT acting - and we tend to forget that.

The opportunities for benefit, which we renounce because we don't want to take a risk, are called *opportunity costs*: What do you risk by not risking? The art of risk management is not simply to refrain from taking risks, but rather to better understand the odds and the nature of the chances you take.

This is true in large and small. A very common objection against relying on blogs, amateur sites and wikis for research is that you cannot be sure that the information you find is accurate.

If you look up an entry in the big, classic Encyclopedia Britannica, you can be virtually certain that the information is correct - or that it was, anyway, at the time it was printed. If you look up an entry in Wikipedia, there is some risk that the information is less correct. The result is less predictable, and this has to be factored into your considerations when using Wikipedia - but mind you, so should the likelihood that the article can be much more topical, more complex, nuanced and not least immediately accessible from any PC on the network. Under rapidly changing circumstances, the latter qualities may very well outweigh the leather-bound authority.

Wikipedia is living, constantly evolving. It is created on a continuous basis in a dynamic, self-organized interaction - and therefore it is less predictable by nature. *Probably* you will get the necessary quality when you look something up. *Maybe* you'll find far more detailed and more diverse information about the topic than in an old fashioned encyclopedia - but maybe it is completely wrong or false. There is no guarantee. It is a calculated risk - but if you are dissatisfied, you very welcome to fix the mistakes, so the next users can avoid them.

Why it's hard to respond to climate change before it's too late

At the very large scale, the prospect of climate change, is a clear example of why it is an extremely risky strategy to insist on certainty before you act in relation to a complex system. The global climate is a system in which the delay between exposure and consequences – *the lag time* – is long and crucial to the outcome. It takes a long time before we can see the full impact of greenhouse gases, and likewise, it will take very long before we could see the benefits, if we make an effort to stabilize the atmosphere as we are accustomed to it.

Our instinctive tendency is to wait investing or making any sacrifice, until we are

absolutely sure that there is a reason for it. But as the sociologist Anthony Giddens says, we face the paradox that if we wait acting until we can observe that climate change in fact is a serious problem, by then it will be too late to avert further disaster.

Anti-complexity policy

There is a political and cultural dimension of our relationship to security, risk and complexity. The world does not stand still. It will change, and it's not a smooth development. It's scary, it's inconvenient, it is unknown and unfamiliar, and it may well mean that the positions and privileges we have enjoyed are challenged or disappear.

Perhaps it is in this light that we should understand the popularity of parties that promote what one might call an "anti-complexity policy". The political agenda of these parties is to preserve the established order, and refuse to accept changes.

One example is the Danish rightwing party *Dansk Folkeparti*. Their rhetoric typically starts by pointing to the chaos that some change is about to bring with it. They then cast themselves as the bulwark against the impending tsunami of all sorts of complicated and complex threats to what we know and love.

Most countries have their own national version of Dansk Folkeparti, and one can easily imagine that this type of anti-complexity policy will become more popular in future as the world's real complexity makes itself felt.

It is perfectly understandable that some feel like saying "no!" and to build walls that can ward off a development that they would rather avoid. But there are also risks associated with it. There may be opportunity costs, because you miss a beneficial development, which an increased international interaction could lead to.

You also risk losing touch with reality. It is one of the fundamental rules of evolution that you must be able to adapt to changing circumstances. Those who survive are those who are able to stay fit.

The world will become more closely integrated, and this will challenge traditional cultures and nation states. If we respond by building walls rather than engaging with the world around us, there is a danger that it will be a very rude awakening the day reality can no longer be kept outside.

Dangers of the precautionary principle

It is easy to point fingers at those who vote for anti-complexity policies. When you belong to the part of the population who probably benefit most from the increasing globalization and rapid change, it’s easy to point out that one should be open and welcoming, because you are basically only experiencing the positive effects.

Finding the balance between new and the well known is harder when it comes to technological development. When assessing a new technology, European regulators often use the "precautionary principle". It assumes that you do not start using a technology broadly unless the manufacturer can prove that it is not harmful. It is on the grounds of the precautionary principle that European politicians have rejected genetically modified crops, meat from animals that have received growth hormones and a number of new additives in foods, pesticides and pharmaceuticals.

The precautionary principle has certainly spared us from the side effects of being human guinea pigs for many immature technologies.

But at what price? If it implies that one forgoes technologies that could save many from suffering and death, it's not so easy to insist that a technology must first be

proven innocent. It is reassuring to be able to delay the introduction of a controversial technology a little, while researchers weed out the worst side effects. But there are difficult dilemmas associated with caution.
An example is the controversy surrounding genetically engineered crops. We will likely have serious problems producing enough food in the coming decades. The trends point toward growing populations, increasing consumption of meat, milk and eggs, in addition to accelerating problems of soil depletion, water shortages, desertification, erosion and climate change. Against this background it seems downright irresponsible not to experiment with genetically engineered crops that could provide increased yields and grow under difficult conditions - although there are several worrying effects associated with using the technology at large scale.

Similarly with nuclear power. It can go horribly wrong, as the meltdowns following the great earthquake in Japan in 2011 showed clearly. The worst nuclear accident so was the Chernobyl reactor meltdown in 1986. 57 people died as a direct result of the disaster, but it is difficult to say exactly how many cases of cancer that the radiation has caused since then. The estimates of the total number of dead vary, but a report from the WHO puts the number at around 4000 people. That is certainly bad enough and it is conceivable that it could go even worse in future nuclear disasters. Moreover, it is still uncertain how to solve the problems of storing radioactive waste.
However, it is worth comparing the consequences that we fear from nuclear power, with the actual damage caused today from the use of coal. The official Chinese statistics show that around 6000 people die in accidents in Chinese coal mines annually. But there are probably hundreds of thousands of deaths worldwide every year due to lung diseases caused by pollution from coal. In addition, coal is the fuel, which causes the largest emissions of CO2, and thus contributes most to global warming.
Against this background, nuclear power - even when one takes the unsolved waste problems into account – appears as the lesser evil in a future where we will be under pressure to use all available ways to produce energy.

There are other technologies in the pipeline with promises of fantastic potential benefits: Biotech may lead to new ways of producing food, new processing technologies, new sources of energy, not to mention the revolution from genetics in medicine. Nanotech will follow close behind with materials that will be stronger, lighter, more conductive and generally equipped with exactly the qualities we want from them. Robots, ranging from very small to very large, are next in line. And then there's artificial intelligence which seeps in to the machines around us and gradually gathers strength as the network connects all processors and all sensors into ever more powerful systems.
We will look closer into the brave new world of technology later in the book. But even from the few developments I've just listed, it is obvious that we will be facing difficult dilemmas when we weigh the power of future technologies with their potential dangers.
Kevin Kelly, former editor at Wired Magazine and a man with a deep understanding of the nature of technology, has observed that "a technology's strength is proportional to its ability to get out of control and its inherent ability to surprise and generate entirely new relationships". The most powerful technologies are those that could potentially be the most dangerous.
But dare we say no? Can we afford to? We badly need revolutionary technologies and

preferably in a hurry if humanity is to cope with the challenges of the coming decades. On the other hand, we don't want to - once again - solve problems using methods that later prove to have consequences that are almost worse than the original problem.

It's a gamble, and that's the point of this chapter. There will be fewer clear answers and more situations where we must assess the probabilities and adjust out strategies on an ongoing basis as the system's many features unfold. Paradoxes and dilemmas are not anomalies; they are a normal part of the system. In many cases they can't be solved permanently, but they can be *managed* ad hoc.

The growing complexity means that we will increasingly have to act before we have the certainty we could wish for. Acting on probabilities is a competence we will have to acquire.

We can see that complex systems behave differently from the linear systems we are accustomed to. Therefore, we must act against our immediate intuition when we try to handle them. No one likes to engage in unsafe bets, but we must realize that it is also a gamble *not* to act.
By definition, it's impossible to learn to predict the fluctuations of complex systems, but if you understand the rules and the mechanisms that characterize them - *feedback loops, tipping points, phase shifts* etc. - then you are far better equipped to navigate through the opportunities.